

SE0001134

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

BERGLUND, Erik  
Berglunds Patentbyrå AB  
Aspebråten  
S-590 55 Sturefors  
SUÈDE

Date of mailing (day/month/year) 04 October 2001 (04.10.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference P9918PC	
International application No. PCT/SE00/01134	International filing date (day/month/year) 31 May 2000 (31.05.00)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent
<input type="checkbox"/> the common representative		
Name and Address NORDIC SENSOR TECHNOLOGIES AB Teknikringen 6 S-583 30 Linköping Sweden	State of Nationality SE	State of Residence SE
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input checked="" type="checkbox"/> the name	<input type="checkbox"/> the address
<input type="checkbox"/> the nationality		
<input type="checkbox"/> the residence		
Name and Address APPLIEDSENSOR SWEDEN AB Teknikringen 6 S-583 30 Linköping Sweden	State of Nationality SE	State of Residence SE
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Athina NICKITAS-ETIENNE
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

replaced by  
Article 34

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Claims

1. Micro-hotplate device with integrated chemical sensor, which comprises:
  - a) a support substrate;
  - b) a supported membrane, attached to said support substrate, extending over a well in  
5 said support substrate;
  - c) an island attached to said membrane so as to be electrically and thermally isolated  
from said substrate, said island consisting at least partly of a semiconducting  
material;
  - d) one or several heating elements integrated in said island;
  - 10 e) one or several temperature-sensing elements integrated in said island;
  - f) one or several active microelectronic devices integrated in said island, where at  
least one of said active microelectronic devices is a chemical sensor whose  
chemically active layer is exposed to the ambient.
2. A micro-hotplate device according to claim 1, wherein at least one heating element  
15 consists of a heating transistor.
3. A micro-hotplate device according to claim 1, wherein at least one heating element  
consists of a heating resistor.
4. A micro-hotplate device according to any of the claims 1-3, wherein at least one  
temperature-sensing element is a temperature-sensitive resistor.
- 20 5. A micro-hotplate device according to any of the claims 1-3, wherein at least one  
temperature-sensing element is a temperature-sensitive diode.
6. A micro-hotplate device according to any of the claims 1-5, wherein said membrane  
consists of one or several insulator layers.
7. A micro-hotplate device according to claim 6, wherein at least one insulator is silicon  
25 nitride.
8. A micro-hotplate device according to claim 6 or 7, wherein electrically conducting leads  
to the active microelectronic devices on the island have been placed between different insulator  
layers.
9. A micro-hotplate device according to any of the claims 1-8, wherein the  
30 semiconducting material in the island is silicon.
10. A micro-hotplate device according to any of the claims 1-8, wherein the  
semiconducting material in the island is silicon carbide.
11. A micro-hotplate device according to any of the claims 1-10, wherein the support

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substrate and the island are made of the same material.

12. A method for the fabrication of a micro-hotplate device according to claim 1, characterized in the use of a combination of masking steps and etching steps to define the geometry of the device.

5 13. A method according to claim 12, characterized in the use of consecutive backside etching steps comprising:

- a) depositing the supporting membrane over the silicon substrate;
- b) one etching step is used to define the thickness of the island by etching away the region surrounding the island to a certain wanted depth, equal to the wanted thickness of the island;
- 10 c) another etching step is used to etch the island and surrounding region until the island is isolated from the support substrate.

14. A method according to claim 12, characterized in the use of a silicon-on-insulator wafer as substrate whereby the buried insulator layer in said silicon-on-insulator wafer is used as an etch stop to define the thickness of the island of the device, resulting in a silicon island with an insulator layer on backside.

15 15. A method according to claim 14, characterized in the use of the following steps:

- a) etching away from the front side of the device the region surrounding the island down to the buried insulator layer;
- 20 b) etching away from the back side of the device the silicon in the region below the island and the region surrounding the island until the buried insulator layer on the island is exposed and the island is attached to the support by the insulator layer.

16. A method according to claim 14, characterized by the following steps:

- a) oxidizing the silicon layer on the front side of the device down to the buried insulator layer, except for the region where the island should be;
- 25 b) etching away from the front side of the device the oxide in the region surrounding the island until the underlying silicon substrate is exposed;
- c) etching away from the back side of the device the silicon in the region below the island until the buried insulator layer on the island is exposed and the island is attached to the support by the remaining part of the insulator layer.

17. A method according to any of the claims 12-16, wherein at least one of said etching steps is an anisotropic potassium hydroxide etching step.

18. A method according to any of the claims 12-16, wherein at least one of said etching

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steps is an anisotropic tetramethyl ammonium hydroxide etching step.

19. A method according to any of the claims 12-16, at least one of said etching steps is a deep reactive ion etching step.

20. A micro-hotplate device according to any of the claims 1-12, wherein one or several of the chemical sensors utilize the field-effect detection mechanism.

21. A micro-hotplate device according to claim 20, wherein one or several field-effect chemical sensors are combined with one or several chemical sensors that utilize a detection mechanism different from the field effect.

22. A micro-hotplate device according to any of the claims 1-12 or 21, wherein one or several of the chemical sensors are operated as gas sensors.

23. A micro-hotplate device according to claims 21 and 22, wherein one or several field-effect gas sensors are combined with one or several gas sensors that utilize resistance changes as detection mechanism.

24. A micro-hotplate device according to claim 23, wherein at least one of the gas sensors that utilize resistance changes as detection mechanism is made of a semiconducting metal oxide.

25. A micro-hotplate device according to claim 23, wherein at least one of the gas sensors that utilize resistance changes as detection mechanism is made of a polymer.

26. A micro-hotplate device according to any of the claims 1-12 or 20-25, wherein the support substrate contains an array of several islands.

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

REC'D 27 SEP 2001

PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P9918PC	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE00/01134	International filing date (day/month/year) 31.05.2000	Priority date (day/month/year) 04.06.1999
International Patent Classification (IPC) or national classification and IPC <sub>7</sub> G 01 N 27/414, G 01 N 27/18		
Applicant Appliedsensor Sweden AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  20.12.2000	Date of completion of this report  20.09.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Bertil Dahl/ELY Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01134

## I. Basis of the report

## 1. With regard to the elements of the international application:\*

- ☐ the international application as originally filed
- ☒ the description:  
pages 1-6 , as originally filed  
pages \_\_\_\_\_ , filed with the demand  
pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_
- ☒ the claims:  
pages 8 , as originally filed  
pages \_\_\_\_\_ , as amended (together with any statement) under article 19  
pages \_\_\_\_\_ , filed with the demand  
pages 7, 9 , filed with the letter of 03.08.2001
- ☒ the drawings:  
pages 1-2 , as originally filed  
pages \_\_\_\_\_ , filed with the demand  
pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
pages \_\_\_\_\_ , as originally filed  
pages \_\_\_\_\_ , filed with the demand  
pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-27</u>	YES
	Claims	_____	NO
Inventive step (IS)	Claims	<u>1-27</u>	YES
	Claims	_____	NO
Industrial applicability (IA)	Claims	<u>1-27</u>	YES
	Claims	_____	NO

**2. Citations and explanations (Rule 70.7)**

The present application relates to a micro-hotplate device with integrated chemical sensors and a method for making it. The characterising feature of amended claim 1 is that at least one of the sensors is a gas-sensitive field-effect sensor.

The cited documents WO 94/10822 A1 (D1) and WO 94/10821 (D2) disclose micro-hotplate devices including means for measuring temperature and electric properties of materials during heating.

None of the documents, however, disclose a micro-hotplate device including a gas-sensitive field-effect sensor.

The device and method according to amended claims 1-27 are therefore novel. They are also considered to satisfy the criteria of inventive step, since it becomes possible to use chemical sensors of the gas-sensitive field-effect type in a micro-hotplate device, and industrial applicability.



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01134

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01N 27/414, G01N 27/18

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9410822 A1 (THE UNITED STATES OF AMERICA AS REPRESENTED BY THE UNITED STATES DEPARTMENT OF COMMERCE), 11 May 1994 (11.05.94), page 8, line 2 - line 3; page 3, line 18 - page 4, line 20, figure 5  --	1-26
X	WO 9410821 A1 (UNITED STATES OF AMERICA, AS REPRESENTED BY THE UNITED STATES DEPARTMENT OF COMMERCE), 11 May 1994 (11.05.94), abstract  -----	1-26

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

28 Sept 2000

Date of mailing of the international search report

09 -10- 2000

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

01/08/00

International application No.  
**PCT/SE 00/01134**

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9410822	A1	11/05/94	US	5464966 A	07/11/95
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WO	9410821	A1	11/05/94	AU	5450194 A	24/05/94
				US	5356756 A	18/10/94
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